REMARKS

Applicants have carefully reviewed the contents of the Office Action mailed February 28, 2005 in which the subject matter of claim 2 was indicated as being allowable over the prior art of record. Reconsideration is respectfully requested in view of the foregoing amendments and the comments set forth below.

By this Amendment, indicated allowable claim 2 is rewritten in independent form to recite the features of independent claim 1. No amendments are made to the remaining claims. Accordingly, claims 1-29 are pending in the present application.

Claims 1, 4-9, 16-20 and 25-27 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,490,319 to Yang as explained in paragraph 3 spanning pages 2 and 3 of the Action. In addition, claims 3, 10, 12-15, 21-24 and 28-29 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang in view of U.S. Patent No. 5,990,957 to Ryoo as described in paragraph 5 of the Action. These rejections are respectfully traversed.

As described in the Amendment filed September 17, 2004, the claimed invention is directed to a bit allocation technique for object-based video encoding. Independent claim 1 is directed to a method and claim 18 is directed to an apparatus in "means-plus-function" format. Both claims 1 and 18 recite "encoding said video sequence based on balancing bits per pixel for said background composite with bits per pixel for said foreground regions to achieve similar quality between the background composite and the foreground regions in a reconstructed video sequence." Thus, the claimed invention clearly recites encoding a video sequence based on balancing bits per pixel. Since claim 18 recites "means for encoding ...", the sixth paragraph of Section 112 applies and the means described in the specification must be disclosed by the prior art.

According to the described invention, an appropriate bit allocation between a background composite and foreground regions for a video is determined. That is, the background of the instant invention is encoded only once as the background of each individual frame is a sub-region of the background composite (the overall background or sprite). While, on the other hand, the foreground shape can change from frame to frame. See page 8, lines 8-10 of the present application. However, the number of bits in the compressed background composite and the number of bits in the compressed foreground regions are related to a bit budget. That is, the bit budget is fixed for the whole sequence. Claim 1 recites the above features by describing the video sequence as "comprising a background composite **for all the video frames** and list of **different foreground regions for different frames**" (emphasis provided). Claim 18 recites that the video sequence includes "a background composite and foreground regions" (emphasis provided). This is shown in the attached exemplary material entitled "Allmen's video compression approach".

Yang is directed to region of interest video coding where every frame of the video has the same region of interest. According to the Action, Figure 4; column 1, lines 29-60; column 1, line 65 through column 2, line 7; and column 3, lines 33-42 of Yang provide support for the assertion that Yang anticipates claims 1 and 18. Column 1, lines 29-60 describes the background of the Yang invention, and clearly discloses balancing the quality differential content and data rate of a video image. That is, Yang discloses a balancing of quality differential content where highest quality occurs in the foreground image and a blurry background image results, if the background image is of no interest. Two different quantization levels are disclosed to compress different regions of a video

image from column 1, line 65 through column 2, line 7 of Yang. Neither cited passage of Yang discloses "encoding said video sequence based on balancing bits per pixel for said background composite with bits per pixel for said foreground regions to achieve similar quality between the background composite and the foreground regions in a reconstructed video sequence", as required by independent claims 1 and 18. Instead of balancing bits/pixel for a video sequence comprising a background composite for all the video frames and list of different foreground regions as required by the claimed invention, Yang is directed to a video compression technique where only a portion of a video sequence is discussed. That is, Yang's technique is based on a video **frame** that includes a background 102 and a region of interest. Nowhere does Yang disclose an equation for obtaining quantization levels for more than one frame with the disclosed technique. This is in contrast to the present, claimed invention which encodes a video sequence defined as comprising a background composite and foreground regions (claims 1, 18-19 and 27).

The third passage cited in the Action (column 3, lines 33-42 of Yang) assumes that both regions of a video image are quantized to the same level and, as a result of this assumption, there is no quality contrast differential between the two regions of the video image. Yang does not disclose the recited encoding step of claim 1; nor does Yang disclose balancing bits per pixels for a background image with bits per pixel for a foreground image. Figure 4 of Yang does not supply the missing features. Instead, Figure 4 discloses defining a region of interest and then selecting a quality contrast level between the region of interest and the background. Thus, Yang is directed to a video coding system and method that provides a contrast level between the region of interest and the background.

Yang discloses in column 5, lines 15-22 that the quantization for the background, Q_{back}, is computed using the available background data bits and the size (# of pixels) for the background. While the bit budget is fixed for every frame in Yang, Q_{fore} (the area of interest) is determined first in Step 406 and then, the remaining number of bits available for the image is used to calculate the quantization of the background (Step 408 of Yang). While the quantization of the background depends upon the quantization of the region of interest, Yang does not disclose encoding a video sequence based on "balancing bits per pixel for said background composite with bits per pixel for said foreground regions to achieve similar quality between the background composite and the foreground regions in a reconstructed video sequence", as required in independent claims 1 and 18. It is respectfully submitted that **balancing** bits/pixel between the foreground and the background is not the same as using the left over bits to calculate the quantization for the background. Thus, Yang fails to disclose the recited encoding step of claim 1 and the means for encoding as set forth in claim 18. Consequently, Yang cannot anticipate claims 1, 4-9, 11, and 16-18. Withdrawal of this rejection is requested.

Claims 19 and 27 are directed to a method and apparatus respectively which include, among other features, "determining a background quantization step for said background composite based on a number of bits for a compressed background composite and an actual number of bits for said compressed background composite" and "determining a starting foreground quantization step for said foreground regions based on said background quantization step and a desired bit-rate. In addition, there are two encoding steps, one step encodes background composite based on the background quantization step and the second step encodes foreground composite based on the starting

foreground quantization step. Claim 27 is in "means-plus-function" format and thus, invokes paragraph six of Section 112. As a result, the recited "means" as described in the specification (or an equivalent thereof) must be disclosed by the prior art of record.

Contrary to the Action's position, claims 19 and 27 are not "substantially similar to claims 1 and 11" (page 3 of the February 28, 2005 Action, lines 9-10). As noted above, the method claims has two steps in addition to two encoding steps. Similarly, the apparatus claim recites in "means-plus-function" more elements as opposed to the single element in claims 18.

Figure 4 of Yang discloses that foreground quantization step 406 occurs before the calculation of the background quantization (Step 408). Thus, Yang describes calculating the background quantization based on the foreground quantization. This is not "determining a background quantization step for said background composite based on a number of bits for a compressed background composite and an actual number of bits for said compressed background composite" as recited in claim 19.

According to column 5, lines 8-12 of Yang, a region of interest is first defined and then a quality contrast level A is selected at step 404 in Figure 4. Using the selected contrast level, the foreground quantization level is calculated in step 406. Thus, Yang determines the desired contrast level first and then determines the foreground quantization level. This is not "determining a starting foreground quantization step for said foreground regions based on said background quantization step and a desired bit rate", as recited in claim 19. Nor is Yang's disclosure describing "encoding said foreground regions based on said starting foreground quantization step to achieve similar quality between the background composite and the foreground regions in a reconstructed

video sequence" (claim 19, lines10-12 of the present application). To the contrary, Yang discloses determining the contrast level first and then calculating foreground quantization level, which is followed by calculation of the background quantization. Consequently, even if Yang assumes a differential quality of contrast between the background and the foreground of a video image is zero, the recited method steps of claim 19 and the means for achieving those functions are not disclosed by Yang. As argued above, Yang is missing the two determining and two encoding steps of claim 19 and the corresponding, recited "means-plus-function" elements of claim 27. As a result, Yang cannot anticipate claims 19-20 and 25-27 because Yang fails to disclose each and every claimed feature.

In summary, the encoding goal of Yang is to enable adjusting the contrast between foreground and background by encoding foreground and background using different quantization steps. A goal of the claimed invention is to make the foreground regions and background composite have the same visual quality by assigning the bits smartly. According to Yang, the same quantization of the foreground and the background corresponds to the same encoding and visual quantity. In the claimed invention, the background composite or sprite may use only I-frame encoding, while most of the foreground uses P-frame encoding. As a result, if the background and foreground of the invention have the same quantization level, the encoding and visual quality may be quite different. As explained on page 2, line 16 through page 3, line 2 of the present application, "simply setting the quantization step equal for both the background composite and the foreground composite does not necessarily result in similar reconstructed quality between the background composite and foreground regions." The attached exemplary material entitled "Yang's video compression approach" pictorially

illustrates how one of ordinary skill in the art would have understood the Yang disclosure. Thus, from the exemplary material pictorially illustrating Allmen's invention and based on the knowledge of one of ordinary skill reading the originally-filed application, it is clear that the present invention by Allmen *et al.* is solving a different problem from that of Yang and a much more complex problem.

As described on page 8, lines 1-4 of the present application: "the inventors determined that if the bits per pixel is the same for the background composite and the foreground regions, the quality of the background composite and the foreground regions in the reconstructed video can be expected to be similar" (emphasis provided). That is, Applicants' invention ensures that reconstructed video **sequences** have similar visual quality on both the foreground and background regions so that the background and foreground would look more natural to a human viewer even under a very low bit-rate compression.

As argued above, Yang fails to disclose balancing the bits per pixel of the background with bits per pixel of the foreground regions. Nowhere does Ryoo disclose, teach or suggest balancing the bits per pixel of the background composite and the foreground regions, or the four steps of claim 19 and the corresponding "means-plus-function" elements of claim 27. Accordingly, claims 3, 10, 12-15, 21-24 and 28-29 should allowable over any combination of Yang and Ryoo at least for those reasons.

In addition, Ryoo also fails to discuss achieving a similar quality between the background composite and foreground regions in a reconstructive video sequence as recited in independent claims 1, 18-19 and 27. The traditional way of controlling compression quality of a video using quantization steps as taught by Ryoo is not

sufficient for object-based coding of a video because the same quantization step for the background and foregoing regions will correspond to different visual quality on these two different regions. As a consequence, object segmentation artifacts emphasized in an encoded video thus significantly decrease the visual quality of the reconstructed video. Accordingly, it is respectfully submitted that one of ordinary skill in the art would not have considered the teachings of Ryoo to modify and cure the deficiencies of Yang.

Ryoo is directed to a video signal bit amount control using adaptive quantization. That is, Ryoo describes an apparatus for controlling the bit amount of each video object plane (VOP) of a moving picture, the quantization step size (which reflects the encoding quality) is determined based on the significance, complexity and color sensitivity of each VOP. Unlike the present invention, Ryoo's focus is on encoding different foreground objects for an object-based encoding system. Nowhere does Ryoo mention achieving a similar quality between the background composite and the foreground regions in a reconstructed video sequence. Thus, Ryoo has a completely opposite objective than that of the claimed invention. Since Ryoo mainly focuses on the foreground VOP encoding, Ryoo's system is designed to selectively emphasize certain foreground objects by assigning different number of bits for different foreground objects. To the contrary, the claimed system tries to make the composite of the foreground and the background as natural as possible.

Nowhere does Ryoo disclose, teach or suggest determining a background quantization step for the background composite based on a number of bits for a compressed background composite and an actual number of bits for said compressed background composite and determining a starting foreground quantization step for the

foreground regions based on the background quantization step and a desired bit rate. Thus, Ryoo does not disclose, teach or suggest the features missing from Yang with respect to independent claims 19 and 27. Accordingly, it is believed that no combination of Yang and Ryoo could render obvious the claimed invention. Withdrawal of the rejection under 35 U.S.C. § 103(a) over Yang in view of Ryoo is respectfully requested.

It is respectfully submitted that this Amendment After Final Rejection places the application in condition for allowance. The foregoing amendments to claim 2 do not raise new issues and does not raise the issue of new matter, as the subject matter of claim 1 is added thereby rewriting indicated-allowable claim 2 in independent form. Applicants respectfully request that this Amendment After Final Rejection be entered and that this Application be passed to issuance.

If the Examiner believes that a conference would help to advance the prosecution of the present application, the Examiner is encouraged to telephone the undersigned at the number below.

Respectfully submitted,

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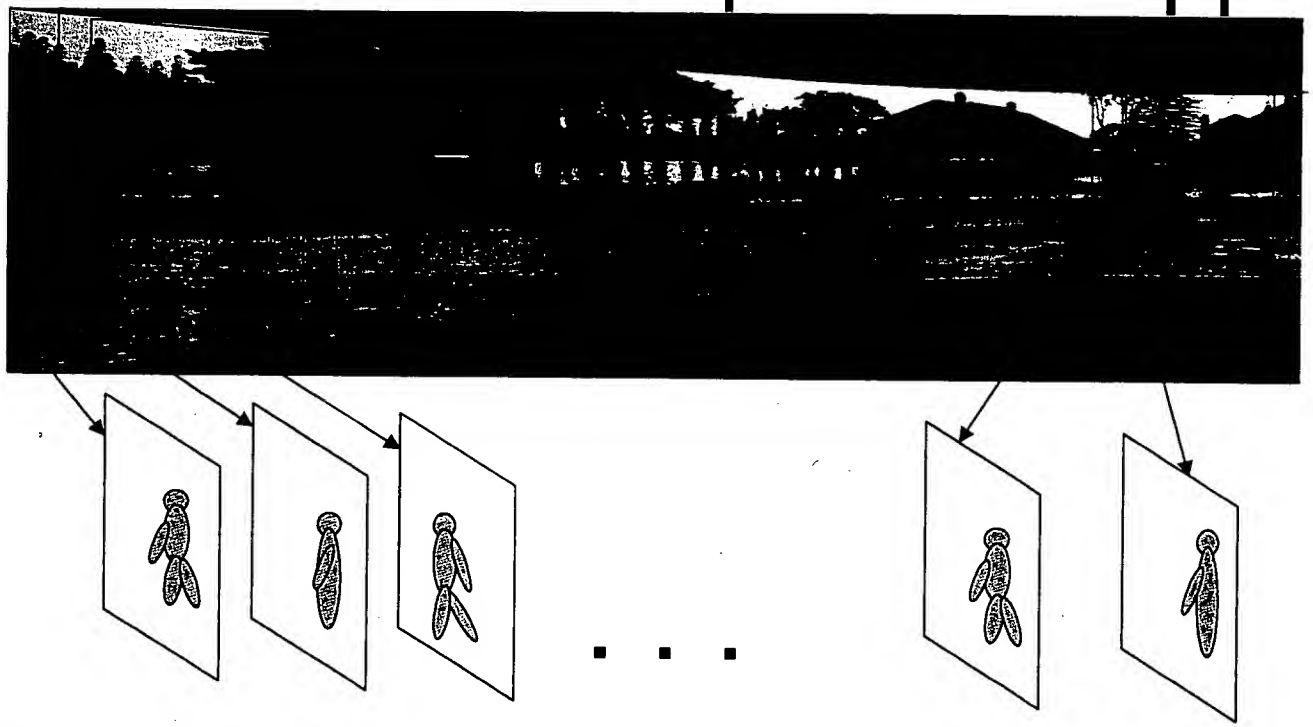
Allmen's video compression approach



One background sprite

Sequence of foreground objects

• **The background (the top image) is encoded only once, thus only I-frame is used. The background of each individual frame is just a sub-region of the big overall background, only four corner points location on the big background is need to be encoded.**

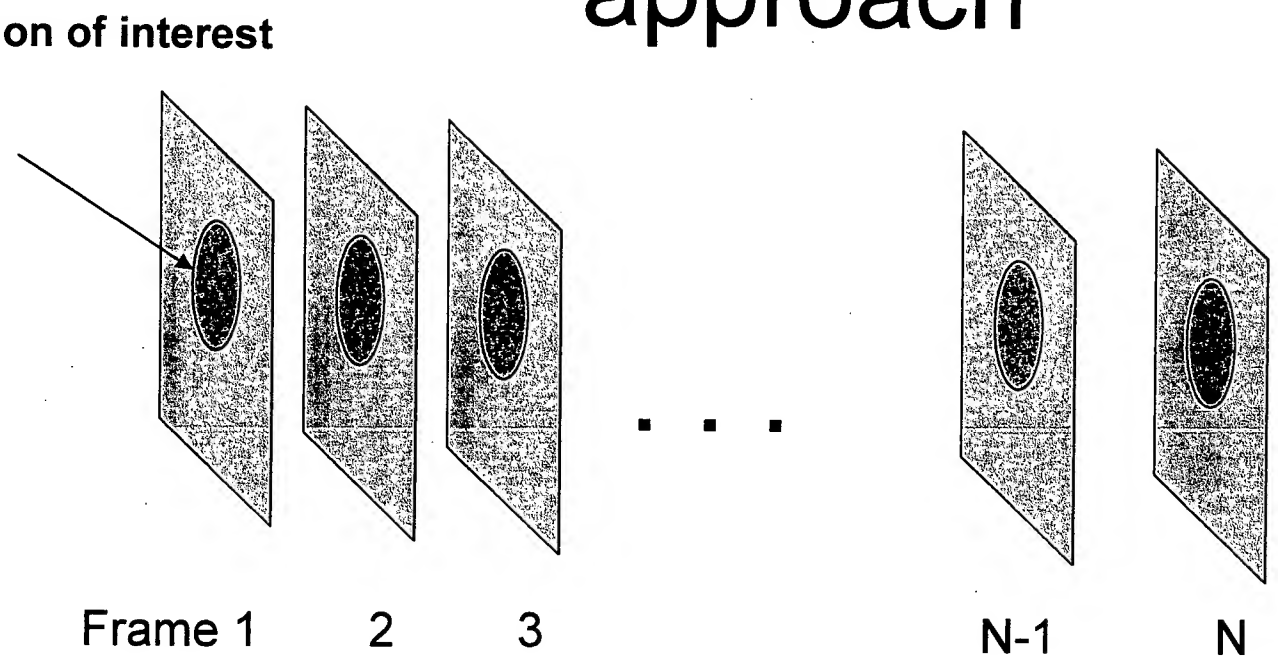
• **Q_{fore} and Q_{back} is expected to the same through out the sequence**

• **The foreground shape usually changes from frame to frame**

• **The bit budget is fixed for the whole sequence, thus bits used for each frame may be quite different, for example, if there is no foreground region, only four points need to be encoded indicating the background; on the contrary, if there is big foreground region, a lot more bits may needed for the frame. Thus select appropriate Q_{fore} and Q_{back} to use up exactly the assigned bits is much more complex than that only consider one frame each time.**

Exemplary material (09/809,036)

Yang's video compression approach



- Need to manually specify regions for each frame, so usually use same region of interest for every frame in the sequence
- Every frame has its own foreground and background that need to be encoded.
- The bit budget is fixed for every frame, thus Q_{fore} and Q_{back} are computed for each frame. Q_{fore} and Q_{back} can be different for different frames
- I-Frame and P-frames are used for both foreground and background